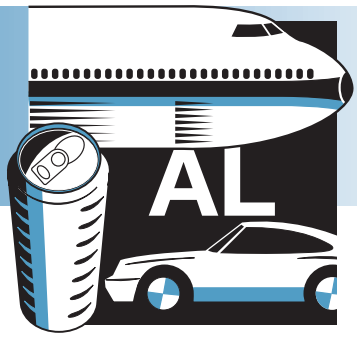
ALUMINUM

Project Fact Sheet



POTLINING ADDITIVES

BENEFITS

- Potential energy savings of about two trillion British thermal units (Btu) annually by increasing cell efficiency in the U.S. by 2010
- Potential energy cost savings of $23 million annually by 2010 [about $5,000 per year for a 150 kiloampere (kA) production cell]
- Improved pot operation and extended cell life leading to a potential non-energy cost savings of one million dollars annually by 2010
- Significant reduction of the cyanide in spent potliners, leading to lower cost options for environmentally sound disposal

APPLICATIONS

Boron oxide additions to potlining are expected to promote smoother and more energy efficient cell operation due to wetting of the carbon by the metal product, enhance pot life due to reduced intercalation, and suppress cyanide formation. This technology can be applied whenever small amounts of titanium are acceptable in the metal product, in new or retrofitted cells.

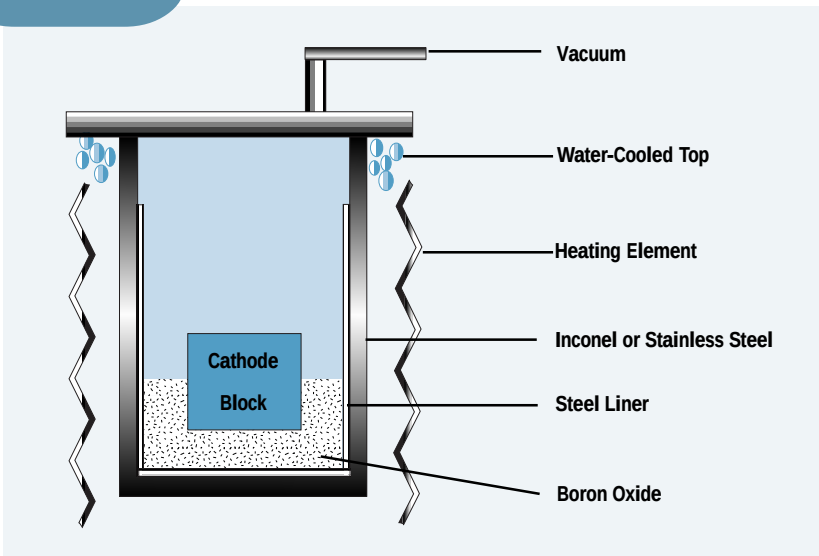
BORON OXIDE ADDED TO POTLINING WILL INCREASE ENERGY-EFFICIENCY AND OPERATIONS IN PRIMARY ALUMINUM PRODUCTION

Since the invention by Hall and Héroult more than a century ago, aluminum has been produced by electrolysis of aluminum oxide dissolved in a fluoride melt. Although there has been continuous progress to increase affordability, smelting remains as the most energy-intensive process in aluminum production.

Preliminary research results obtained by EMEC Consultants (which yielded a U.S. Patent) indicates that cell operation, cathode performance, and options for the disposal of spent potlining will be improved by additives to potlining. The addition of boron oxide to potlining especially has been considered a promising way to suppress cyanide formation. This project is designed to further examine the potential benefits derived from the addition of boron oxide to potlining used in primary aluminum production cells. It addresses a high-priority topic of the Primary Products Sector related to research and development (R&D) for improving the Hall Héroult process in the *Aluminum Industry Technology Roadmap*.

A relatively inexpensive bulk chemical, boron oxide not only suppresses cyanide formation, but also may inhibit sodium intercalation and, above all, promote, in the presence of some titanium, wetting of cathode carbonaceous material by the metal pad, thus reducing ohmic cell resistance and sludge formation. Improvements in energy consumption, waste disposal and overall economics of the process are projected.

INDUSTRIAL CELL



Impregnation of a cathode block with boron oxide.

Project Description

Goals: Establish the technical feasibility and performance data of adding boron oxide to the carbonaceous components of the lining of aluminum electrolysis cells and research the effects and potential benefits that can be derived from additives to the potlining of traditional aluminum reduction cells.

Laboratory testing and commercial scale testing will investigate parameters that are important for the commercial application. Tests in industrial cells will complement laboratory testing. This experimentation is scheduled for the first year. Carbonaceous potlining components added with boron oxide will be incorporated in industrial cells in later phases of the program, providing results in the first year are positive. Partial installation is planned for the second year, equipping full cells with blocks containing boron oxide for the third phase of the program. In this third phase, performance of the material will be examined as well as cell operating data established. Following a validation of the concept in the laboratory, tests will be conducted in the industrial environment of the participating companies.

Progress and Milestones

The project will be conducted in three phases. Phase I includes laboratory studies and tests of samples in industrial cells of two participating primary aluminum producers. In case of a positive go/no-go decision towards the end of Phase I, material will be prepared in Phase II to be installed in industrial cells, which will be operated for six months and then inspected. Carbon blocks to equip two full cells will be impregnated with boron oxide in Phase III; cell operational data will be gathered to assess achieved improvements.

(1) Verification and Quantification of Effects (Fall 1999)
(2) Partial Tests in Industrial Cells (Fall 2000)
(3) Testing of the Concept in an Entire Industrial Cell (Fall 2002)

Commercialization Plan

If industrial testing is successful, the additive should quickly become commercially viable. Using the new additives is expected to be more economical than current practice. Market introduction of boron oxide as a potlining additive is anticipated in the near-term time frame.

Project Partners

Century Aluminum of West Virginia, Inc.
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EMEC Consultants
Export, PA

NSA Division of Southwire Company
Hawesville, KY

SGL Carbon Corporation
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